ROCKY MOUNTAIN OILFIELD TESTING CENTER
Texaco Dual Action Pumping System
PROJECT TEST RESULTS
March 16, 1998

Michael R. Tyler
Project Manager

Abstract

The Texaco Dual Action Pumping System (DAPS) is designed to separate water from the oil in the casing-tubing annulas and inject most of the water into a lower formation while lifting the oil and remaining water to the surface. As oil production declines in a well the water production can increase. The lifting cost can be reduced per barrel of oil if less water is brought to the surface and processed.

The DAPS was installed in a well that had been producing four (4) barrels of oil per day (bopd) and 46 barrels of water per day (bwpd), from the zone that became the injection zone. The well was recompleted in a shallower zone that was expected to yield an excessive quantity of water. Production had increased to more than 10 bopd (and 38 bwpd with simultaneous injection of 180 bwpd) about the time the test was ended.

The test successfully accomplished a primary purpose of obtaining quantitative data to verify and improve the modeling/design process. The test also verified that the downhole oil, water, and gas gravity segregation phenomenon could be exploited with this technology.

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TECHNICAL DESCRIPTION:

The Texaco Dual Action Pumping System (DAPS) was field tested at the Rocky Mountain Oilfield Testing Center (RMOTC). The (DAPS) is designed to separate water from the oil in the pump and inject most of the water into a lower formation. The oil and remaining water are brought to the surface. A distinguishing characteristic of DAPS is that it consists of coupled rod pumps with two, vertically separated intakes.

PROBLEM:

Many companies, using conventional rod pump systems of artificial lift within the USA, produce more than nine (9) barrels of water for every barrel of oil produced. This increases both lifting and investment costs and exposes the environment to potential damage. By segregating oil and water downhole and injecting most of that water, these adverse consequences can potentially be reduced. Additionally, excessive water can often limit production because of artificial lift or facilities constraints.

SOLUTION:

DAPS is the first artificial lift technology to employ downhole oil, water, & gas gravity segregation to minimize the amount of water lifted to the surface (by injecting most of it downhole) while producing all oil and gas to surface. As oil production declines in a well the water production can increase. The lifting cost can be reduced per barrel of oil if less water is produced to the surface.

OPERATION:

The DAPS was installed in a well that had been producing four (4) barrels of oil per day (bopd) and 46 barrels of water per day (bwpd), from the zone that became the injection zone. The well was recompleted in a shallower zone that was expected to yield an excessive quantity of water. Production had increased to more than 10 bopd (and 38 bwpd with simultaneous injection of 180 bwpd) at the time the test was ended.

BENEFITS:

Increase revenues in wells constrained by lift capacity
Lower operating expenses
Lower lifting costs
Reduce energy requirements
Demonstrated feasibility of using DAPS to produce oil from a shallow zone and waterflood a deeper zone simultaneously

TEST RESULTS:

The DAPS was tested on Well 77-TX-20 at the Naval Petroleum Reserve 3 (NPR-3). The well originally produced from the Third Wall Creek (3rd WC) formation. It was recompleted to produce from the Second Wall Creek (2nd WC) and to inject water into the 3rd WC formation.

Well History:

Depth:	PBTD	2981'
Casing:	15.000"	40'
	9.625"/32.30#	316.18'
	5.5715.50#	3039.75'
Perforations:	3rd WC	2970'-2978' 4/1'
	2nd WC	2738'-2747' 4/1'
	2nd WC	2750'-2763' 4/1'
Tubing	2.875"	
Rods:	.750"	
Pump:	DAPS	9" Diameter
Pump Intake	267 1'	
Pumping Unit	American	C-1 14-119-86
Stroke Length:	6211	
Strokes Per Minute	8.5	
Rotation	CCW	

The DAPS was installed on February 11, 1997 and operated through March 23, 1997. The well produced an average of 8.75 bopd and 30.06 bwpd while injecting an average of 131 bwpd into the 3rd WC. The Strokes Per Minute (SPM) were increased on the pumping unit and production averaged 8.86 bopb and 37.11 bwpd while injecting 150 bwpd.

The well filled with frac sand from the recompletion. A fresh water injection test of the 3rd WC formation caused the formation clays to swell and pressure up. This caused the rods to stack and the unit was shut down. The 3rd WC was treated with acid to lower injection pressure and increase rates but was unsuccessful. The test was then ended.

TECHNICAL OBSERVATIONS:

The test successfully accomplished a primary purpose of obtaining quantitative data to verify and improve the modeling/design process. It also verified that the downhole oil, water, and gas gravity segregation phenomenon could be exploited with this technology.

SUMMARY:

The Texaco DAPS test was successful. The production rate on the well did increase and the data that was obtained verified the process. The formation used for injection sealed off and the project was terminated early. The test successfully accomplished a primary purpose of obtaining quantitative data to verify and improve the modeling/design process. The test verified that the downhole oil, water, and gas gravity segregation phenomenon could be exploited with this technology that is now commercially available.

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